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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/523,251  
Filing Date: August 30, 2005  
Appellant(s): SCHLUCKWERDER ET AL.

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Clifford A. Ulrich  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 9/16/08 appealing from the Office action mailed 3/18/08 and an Advisory action mailed 6/12/08.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

JP 11-292616	Ayako et al.	10-1999
6,054,220	Mroz	4-2000
4,821,142	Ushifusa et al.	4-1989
6,514,890	Nagata et al.	7-2000

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 15 and 22-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ayako et al. (Japanese Pub. No. 11-292616, written translation provided in miscellaneous communication) in view of Mroz (US6054220).**

In regards to claims 15, 22 and 23, Ayako et al. teaches a glass ceramic composite capable of use as a substrate in electronic materials (see [0001]-[0002]) comprising a filler and a glass ceramic comprising oxides of lithium, silicon, and aluminum forming a matrix and further including crystalline phases (see Ayako claim 1). The reference teaches filler materials such as alumina and magnesia, but fails to teach a ceramic filler with an oxygen content of 0.5-2 wt% as required by the instant claims.

Mroz teaches a silica coated aluminum nitride powder useful in the electronic materials packaging arts (see claim 6) and teaches that said powder has superior properties to known fillers in the electronic materials field such as silica and alumina

(see col 1, ln 48-55). The background of Mroz teaches that silica coated aluminum nitride powders have a general oxygen content of 2-4% (see col 2, ln 13-25). Mroz itself teaches examples of such powders in Table 1, having oxygen contents of 2.4-3.2 wt%. One of ordinary skill in the art reading Mroz as a whole would therefore have readily appreciated the 2-4% range disclosed in the background of Mroz also refers to wt%. In addition, one of ordinary skill in the art reading Mroz in its entirety would have appreciated that the oxygen content in the examples taught by Mroz (Table 1) are not critical to the improvement made by Mroz over the silica coated aluminum nitride fillers disclosed in the background. Therefore, one of ordinary skill in the art would have appreciated that the use of silica coated aluminum nitride fillers having an oxygen content of 2-4 wt% was known in the art at the time of Applicant's invention. Mroz further teaches silica coated aluminum nitride powders comprising 1-10 wt% silica content (see claim 17), which would necessarily overlap this compositional range.

It would have been obvious to one of ordinary skill in the art to modify the teachings of Ayako to substitute one known filler such as alumina, with a silica coated aluminum nitride filler as taught by Mroz having an oxygen content of 2-4 wt%. Ayako appreciates the criticality of selecting a filler material with an appropriate thermal expansion coefficient and high thermal conductivity for electronic materials use (see [0002]-[0003]). Thus, one of ordinary skill in the art would have been motivated to make such a modification in order to benefit from the relatively low thermal expansion coefficient and increased thermal conductivity of the coated aluminum nitride as taught by Mroz (see col 1, ln 48-55). In addition, it would have been obvious to one of

ordinary skill in the art to select from the portion of the overlapping ranges of oxygen content. Overlapping ranges have been held to establish prima facie obviousness (see MPEP 2144.05).

In regards to claim 24, Ayako teaches that a glass-ceramic composite material including beta-spodumene (see Ayako claim 1), a lithium-aluminum silicate.

In regards to claim 25, the solubility of nitrogen in the glass matrix is considered an inherent material property. As Ayako teaches a glass-ceramic with substantially the same components and structure, it would necessarily possess this property as well.

In regards to claims 26-27, Ayako et al. teaches the use of 5-70 wt % of fillers. The prior differs in that it uses weight percent instead of volume percent. A theoretical composition of the glass-ceramic as taught by Ayako (comprising 60 wt% SiO<sub>2</sub>, 5 wt% P<sub>2</sub>O<sub>5</sub>, 25 wt% Al<sub>2</sub>O<sub>3</sub>, 5 wt% Li<sub>2</sub>O, and 0-1 wt% each of MgO, ZnO, CaO, BaO, TiO<sub>2</sub>, and ZrO<sub>2</sub>) yields a density of approximately 2.75 g/cm<sup>3</sup> and the filler as taught by Mroz would have a theoretical density of approximately 3.25 g/cm<sup>3</sup> leading to a volume % of fillers of approximately 5-65%, overlapping with the instant ranges. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges in order to optimize the thermal expansion coefficient of the composite material and increase the industrial applicability of the invention.

In regards to claim 28, the heat conductivity of the composite is considered an inherent material property. As the references teach a composite having substantially

the same composition and structure, it would necessarily follow that it possess the same properties.

**Claims 29-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ushifusa et al. (US4821142) in view of Mroz (US6054220).**

In regards to claim 29, Ushifusa teaches a laminated ceramic circuit board comprised of layers of a glass-ceramic material comprising silicon, aluminum, lithium, and oxygen (see Ushifusa claim 2). Ushifusa further teaches the use of a filler such as silica (see col. 3, lines 22-47) and teaches the use of 0-5 wt% of aluminum nitride (see Ushifusa claim 1) but does not teach a filler with the required oxygen content.

Mroz teaches a silica coated aluminum nitride powder useful in the electronic materials packaging arts (see claim 6) and teaches that said powder has superior properties to known fillers in the electronic materials field such as silica and alumina (see col 1, ln 48-55). The background of Mroz teaches that silica coated aluminum nitride powders have a general oxygen content of 2-4% (see col 2, ln 13-25). Mroz itself teaches examples of such powders in Table 1, having oxygen contents of 2.4-3.2 wt%. One of ordinary skill in the art reading Mroz as a whole would therefore have readily appreciated the 2-4% range disclosed in the background of Mroz also refers to wt%. In addition, one of ordinary skill in the art reading Mroz in its entirety would have appreciated that the oxygen content in the examples taught by Mroz (Table 1) are not critical to the improvement made by Mroz over the silica coated aluminum nitride fillers disclosed in the background. Therefore, one of ordinary skill in the art would have appreciated that the use of silica coated aluminum nitride fillers having an oxygen



content of 2-4 wt% was known in the art at the time of Applicant's invention. Mroz further teaches silica coated aluminum nitride powders comprising 1-10 wt% silica content (see claim 17), which would necessarily overlap this compositional range.

It would have been obvious to one of ordinary skill in the art to modify the teachings of Ushifusa to substitute one known filler such as silica, with a silica coated aluminum nitride filler as taught by Mroz having an oxygen content of 2-4 wt%. One of ordinary skill in the art would have been motivated to make such a modification in order to benefit from the relatively low thermal expansion coefficient and increased thermal conductivity of the coated aluminum nitride as taught by Mroz (see col 1, ln 48-55). In addition, it would have been obvious to one of ordinary skill in the art to select from the portion of the overlapping ranges of oxygen content. Overlapping ranges have been held to establish prima facie obviousness (see MPEP 2144.05).

In regards to claim 30, Ushifusa teaches a method of producing a glass-ceramic laminate material with steps of: fusing a composition of glass powder (see compositional ranges in Table 1 below), quenching then pulverizing the glass to a powder, adding silica microspheres (equivalent to ceramic filler), binder, plasticizer, and solvent compounds, coating the mixture on a substrate, then machined, laminated, and fired (equivalent to sintered)(see Ushifusa columns 6-7, example 1).

Table 1

Component	Instant claims 16-17	Ushifusa
SiO <sub>2</sub>	20-68	20-85

$\text{Al}_2\text{O}_3$	10-25	0-25
$\text{Li}_2\text{O}$	5-20	2-20
$\text{B}_2\text{O}_3$	0-35	0-50
$\text{P}_2\text{O}_5$	0-10	0-5
$\text{Sb}_2\text{O}_3$	0-10	
$\text{ZrO}_2$	0-3	0-5

It would have been obvious to one of ordinary skill in the art to select from the portion of the overlapping compositional ranges (see MPEP 2144.05). It would have further been obvious to one of ordinary skill in the art to substitute the silica filler as taught by Ushifusa with a silica coated aluminum nitride filler as taught by Mroz (see rejection of claim 29).

In regards to claim 31, Mroz teaches an aluminum nitride filler (see above).

In regards to claim 32, Ushifusa teaches a firing (sintering) step (see Ushifusa example 1).

In regards to claim 33, Ushifusa teaches the powder mixture is pressed and laminated at a pressure of  $25 \text{ kgf/cm}^2$  before firing (see Ushifusa example 1, column 7, lines 43-45).

In regards to claim 34, Ushifusa teaches the powder mixture formed into films (equivalent to foils), then laminated (see Ushifusa example 1, column 7).

In regards to claim 35, Ushifusa teaches the material fired at a maximum temperature of 850-960 C in air (see Ushifusa example 1, column 7) or in a nitrogen atmosphere (see example 2, column 9).

In regards to claim 36, Ushifusa teaches polyvinyl butryal as a binder, butylphthalyl buylglycolate as a plasticizer, and trichloroethylene, tetrachloroethylene, and n-butyl alcohol as a solvent are added to the powder mixture, deemed equivalent to the instant limitations (see Ushifusa example 1, columns 6-7).

**Claims 16-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ayako et al. (Japanese Pub. No. 11-292616) in view of Mroz (US6054220), further in view of Nagata et al. (US6514890).**

In regards to claims 16-21, the compositional ranges as taught by Ayako and Nagata et al. and the required ranges of the instant claims are found in Table 2 below. Ayako teaches glass composition ranges which overlap the ranges claimed in 16-19, but differs in that it does not disclose the use of optional components of 3-33 wt% B<sub>2</sub>O<sub>3</sub> and 1-5% Sb<sub>2</sub>O<sub>3</sub> as required by claims 20-21.

Nagata teaches compositional ranges which overlap with the required ranges (see Table 2 below). It would have been obvious to one of ordinary skill in the art to modify the composition as taught by Ayako with additives such as B<sub>2</sub>O<sub>3</sub> and Sb<sub>2</sub>O<sub>3</sub> as taught by Nagata (see Nagata table 2). One would have been motivated to make such a modification in order to lower the melting temperature and promote crystal growth in the glass ceramic (see Nagata column 3, lines 18-36). It would have been further

obvious to one of ordinary skill in the art at the time the invention was made to select from the portion of the overlapping ranges, in order to produce a glass-ceramic having high thermal conductivity and strength.

No distinction is made between the claims 16-17 and 18-19 respectively for a 'matrix contains' or 'starting mixture contains' as no significant difference between the two is expected in the final composition from the given claims.

Table 2.

Component	Instant claims 16-17	Instant claims 18-19	Ayako (see claim 1)	Nagata (see claims 1, 4-5)
SiO <sub>2</sub>	20-68	48-66	50-62	65-80
Al <sub>2</sub> O <sub>3</sub>	10-25	14-22	22-26	6.5-15
Li <sub>2</sub> O	5-25	4-20	0-5	3-15
B <sub>2</sub> O <sub>3</sub>	0-35	0-20		0-15
P <sub>2</sub> O <sub>5</sub>	0-10	0-5	5-10	.2-5
Sb <sub>2</sub> O <sub>3</sub>	0-10	0-5		0-5
ZrO <sub>2</sub>	0-3	0-2		.1-.8

#### **(10) Response to Argument**

With regard to appellant's Argument section on pages 3-6 of the Appeal Brief, the appellant's main argument is that Ayako in view of Mroz and likewise Ushifusa in view of Mroz, and Ayako in view of Mroz and Nagata fail to teach a ceramic filler having an oxygen content of 0.5-2 wt%. In particular, the appellant states that the oxygen content range relied upon in the Final Office Action (Mroz col 2, ln 21) is drawn to silica coated

aluminum nitride powders with inferior properties such as mechanical weakness and hydrolysis stability, and further contends that Mroz teaches a 2-4% range but not a weight percent range.

In contrast, the Final Office action relies upon the 2-4% oxygen content range as a general teaching of the oxygen content in known silica coated aluminum nitride powders. One of ordinary skill in the art would appreciate that Mroz is drawn to this same material composition, having an oxygen content that falls within the range of 2-4 wt%. The reference teaches examples of such powders in Table 1, having oxygen contents of 2.4-3.2 wt%. One of ordinary skill in the art reading Mroz as a whole would therefore have readily appreciated the 2-4% range as taught by Mroz at column 2 refers to wt%. In addition, one of ordinary skill in the art reading Mroz as a whole would appreciate that the oxygen content in the examples taught by Mroz are not critical to the improvement made by Mroz over the known fillers having an oxygen content of 2-4 wt%, and therefore do not teach away from powders having this oxygen content. Thus, the teachings of Mroz are not limited to powders having mechanical weakness or hydrolysis problems, as argued by the appellants. Mroz further teaches silica coated aluminum nitride powders comprising 1-10 wt% silica content (see claim 17), which would necessarily overlap with a 2-4 weight percent compositional range. Therefore, it would have been obvious to one of ordinary skill in the art to select from the entire known range of 2-4 wt% oxygen content.

It would have been obvious to one of ordinary skill in the art to modify the teachings of Ayako to substitute one known filler such as alumina, with a silica coated

aluminum nitride filler as taught by Mroz having an oxygen content of 2-4 wt%. Ayako appreciates the criticality of selecting a filler material with an appropriate thermal expansion coefficient and high thermal conductivity for electronic materials use (see [0002]-[0003]). Thus, one of ordinary skill in the art would have been motivated to make such a modification in order to benefit from the relatively low thermal expansion coefficient and increased thermal conductivity of the coated aluminum nitride as taught by Mroz (see col 1, ln 48-55). In addition, it would have been obvious to one of ordinary skill in the art to select from the portion of the overlapping ranges of oxygen content. Overlapping ranges have been held to establish prima facie obviousness (see MPEP 2144.05).

Appellants further argue the contention of the Final rejection that the weight percent content of fillers as taught by Ayako would overlap the required volume percent content of fillers required by claims 26 and 27. Ayako et al. teaches the use of 5-70 wt % of fillers. A theoretical composition of the glass-ceramic as taught by Ayako comprising (60 wt% SiO<sub>2</sub>, 5 wt% P<sub>2</sub>O<sub>5</sub>, 25 wt% Al<sub>2</sub>O<sub>3</sub>, 5 wt% Li<sub>2</sub>O, and 0-1 wt% each of MgO, ZnO, CaO, BaO, TiO<sub>2</sub>, and ZrO<sub>2</sub>) yields a density of approximately 2.75 g/cm<sup>3</sup> and the filler as taught by Mroz would have a theoretical density of approximately 3.25 g/cm<sup>3</sup>. Therefore, the 5-70 wt% filler content would correspond to a volume % of fillers of approximately 4-65%, overlapping with the instant ranges. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected from the overlapping portion of the ranges in order to optimize the thermal expansion coefficient of the composite material and increase the industrial

applicability of the invention. Overlapping ranges have been held to establish prima facie obviousness (see MPEP 2144.05).

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/John A Hevey/

Examiner, Art Unit 1793

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